(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 March 2003 (13.03.2003)

PCT

(10) International Publication Number
WO 03/021324 A1

(51) International Patent Classification[7]: G02B 6/44

(21) International Application Number: PCT/GB02/04015

(22) International Filing Date:
2 September 2002 (02.09.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0121458.4 5 September 2001 (05.09.2001) GB

(71) Applicant *(for all designated States except US)*: **EMTELLE UK LIMITED** [GB/GB]; Haughhead, Hawick TD9 8LF (GB).

(72) Inventors; and

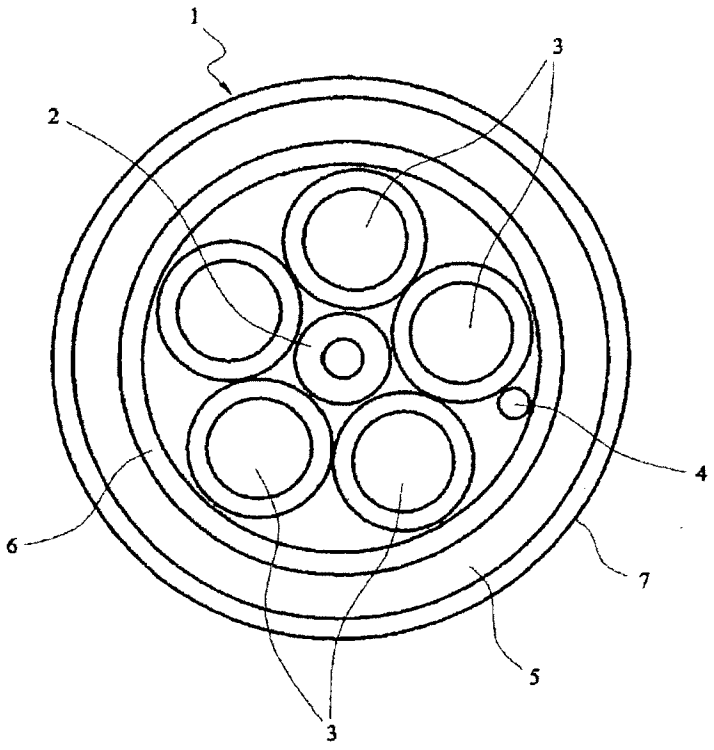
(75) Inventors/Applicants *(for US only)*: **BROWN, George, Henry, Platt** [GB/GB]; Braeholm, Windyknowe Road, Galashiels TD1 1RQ (GB). **STOCKTON, David, John** [GB/GB]; 12 Coppice Close, Woodbridge, Suffolk IP12 1RX (GB).

(74) Agent: **VINSOME, Rex, Martin**; Urquhart-Dykes & Lord, St Nicholas Chambers, Amen Corner, Newcastle Upon Tyne NE1 1PE (GB).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

[Continued on next page]

(54) Title: TUBE ASSEMBLY FOR INSTALLATION INTO A DUCT



(57) Abstract: A tube assembly (1) comprises a dummy tube (2) formed from extruded medium density polyethylene and five primary tubes (3), also formed from extruded medium density polyethylene, and placed around the dummy tube (2). The primary tubes (3) are also provided with a co-extruded lining (not shown) on the internal surface thereof to minimise static attraction and friction between the tubes (3) and optical fibre units (not shown) subsequently installed into the tubes (3). The tubes (2, 3) and a rip cord (4), for subsequently removing the covering layers of the assembly to gain access to the tubes (2, 3), are surrounded by an outer sheath (5) formed from extruded medium density polyethylene. The outer sheath (5) is provided with a non-metallic water barrier (6), and is surrounded by a lubricant polymer layer (7) containing a polyethylene based lubricant compound, the active constituent of the lubricant being an organic silicone slip agent.

WO 03/021324 A1

TUBE ASSEMBLY FOR INSTALLATION INTO A DUCT

The present invention relates to tube assemblies for installation into a duct, and relates particularly, but not exclusively to tube assemblies for carrying optical fibre cables for installation into underground ducts.

Many communications network operators have installed ducts of relatively small diameter (generally known to persons skilled in the art as "sub-ducts") directly into the ground or into larger, main ducts. These sub-ducts are usually made of high density polyethylene and typically are of size 50/40 mm, 40/33 mm, 32/28 mm and 25/20 mm (i.e. outside diameter/ inside diameter). Also, many older ducts are of size 50/40 mm and 40/ 33 mm.

It has been desirable to sub divide these ducts by installing smaller tubes, either as a bundle of tubes encapsulated in a sheath or as several individual tubes. The disadvantage with the first of these methods is that encapsulating the tubes as a bundle produces an item which is relatively stiff. This problem is made worse by the fact that it is desirable for the encapsulating sheath to be manufactured from a material with a relatively low coefficient of friction. It is well known to persons skilled in the art that such low friction materials are manufactured primarily from high density polyethylene, and it is a good general rule that the higher the density the lower the friction. It is also a good general rule that the higher the density the stiffer the material. The problem of encapsulating the tubes producing a stiffer product is therefore aggravated by the additional stiffness resulting from the high density, low coefficient of friction jacket. As a result, such assemblies will not blow very far, particularly in tortuous routes. The need to divide sub ducts exists primarily in metropolitan areas, so routes involve many road crossings and therefore many bends.

An attempt to overcome this problem has been made by blowing individual tubes. The tubes themselves are much more flexible that the assembly. However, this process suffers from the drawback that it is relatively complicated. It is necessary to have multiple drums on site holding the individual tubes. The installation of tubes by blowing is in fact achieved by a combination of pushing and blowing. The pushing device is usually a caterpillar device which

The assembly of the present invention can be blown surprisingly far and rapidly in comparison with the arrangements of the prior art. Furthermore, there is a strong prejudice in the relevant art against attempting to blow several tubes simultaneously, blowing of each tube separately being considered the only method possible. The present invention therefore has the advantage that installation rates are significantly greater than in prior art arrangements.

The first layer may have a flexural modulus of less than 350 Megapascals (Mpa).

At least one said hollow tube may be formed from polyethylene.

In a preferred embodiment, said first layer is formed from polyethylene.

The first layer may be substantially circular in external cross-section.

The first layer may be substantially polygonal in external cross-section.

The first layer may have a thickness of between 0.5mm and 3mm.

At least one said hollow tube may be adapted to receive at least one optical fibre.

The lubricating layer may include an organic silicone material.

The organic silicone material may be a slip agent.

The lubricating layer may include an antistatic material.

The antistatic material may be an amine based material.

The assembly is preferably free of ductile materials.

Example

A cable assembly differing from that of Figure 1 only in that the water barrier 6 has been removed was blown into a 50/40.8 mm ribbed duct by means of a compressed air blowing machine of a type which will be familiar to persons skilled in the art. The results of the blowing operation were as follows

Time (minutes)	Hydraulic Pressure	Air Pressure
0.0	45 Bar	6 Bar
2.0	50 Bar	7 Bar
4.0	50 Bar	7.5 Bar
6.0	60 Bar	8 Bar
8.0	70 Bar	8.5 Bar
10.0	60 Bar	8.5 Bar
10.56	Cable out	

It was found that the cable travelled a total distance of 940 metres in 10 minutes 56 seconds, representing an average installation speed of 85 metres per minute.

Comparative Example

A similar blowing test was carried out on an assembly which differed from the assembly 1 of Figure 1 in that the lubricant layer 7 was absent, an aluminium foil was present as the water barrier 6, and the medium density polyethylene outer sheath 5 was applied more loosely than in the case of assembly 1 of Figure 1. Such a product is known for the purpose of being pulled into duct, but is not suitable for being blown into a duct by means of compressed air.

The results of the tests were as follows

Distance (m)	Speed	Hydraulic Pressure	Air Pressure
226	40m per min	100 Bar	8 Bar

CLAIMS

1. A tube assembly for installation into a duct, the assembly comprising:

at least one hollow flexible tube;

a first layer enclosing the or each said flexible tube and having a flexural modulus of less than 400 Megapascals (Mpa); and

a lubricating layer surrounding said first layer.

2. An assembly according to claim 1, wherein said first layer has a flexural modulus of less than 350 Megapascals (Mpa).

3. An assembly according to claim 1 or 2, wherein at least one said hollow tube is formed from polyethylene.

4. An assembly according to any one of the preceding claims, wherein said first layer is
formed from polyethylene.

5. An assembly according to any one of the preceding claims, wherein the first layer is substantially circular in external cross-section.

6. An assembly according to any one of claims 1 to 4, wherein the first layer is substantially polygonal in external cross-section.

7. An assembly according to any one of the preceding claims, wherein the first layer has a thickness of between 0.5mm and 3mm.

8. An assembly according to any one of the preceding claims, wherein at least one said

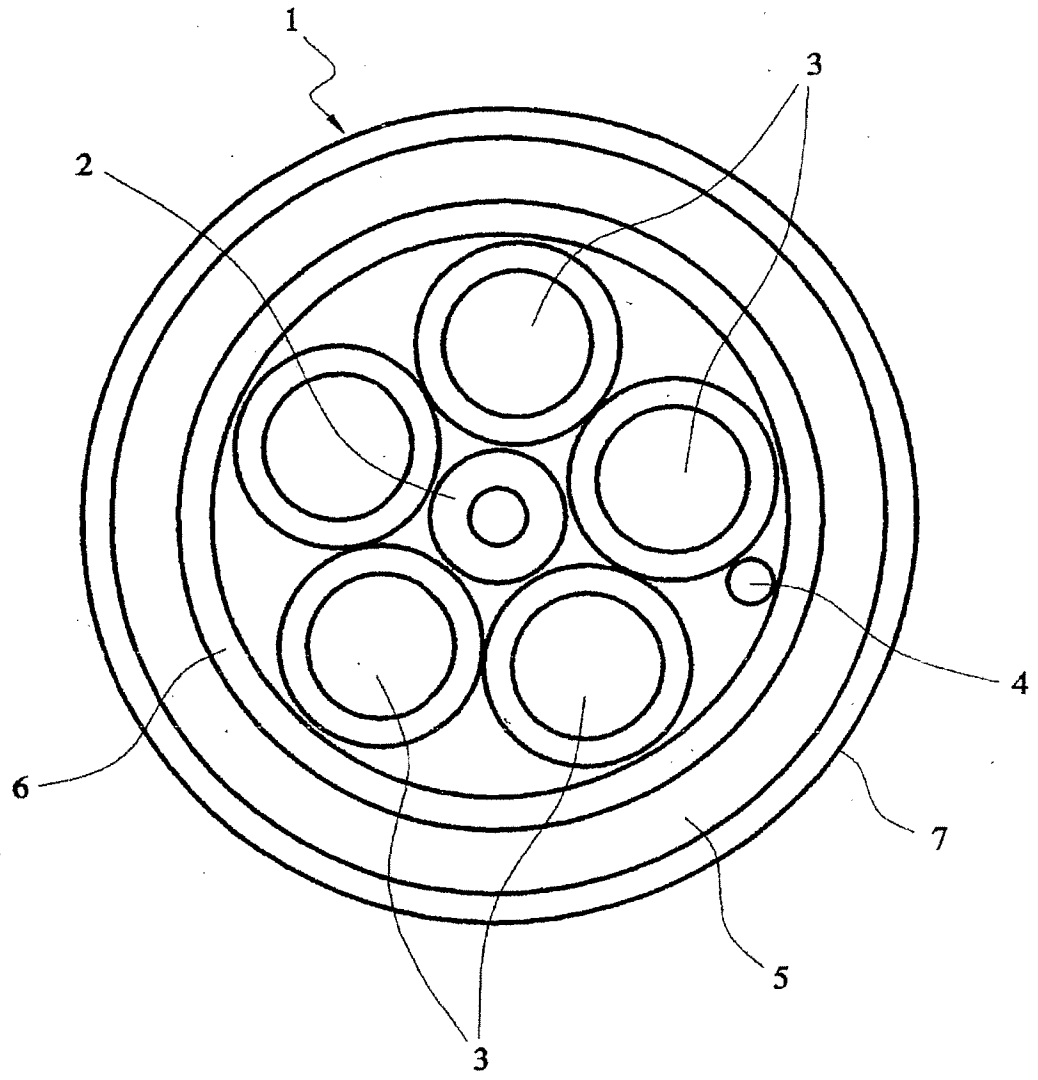


FIG. 1